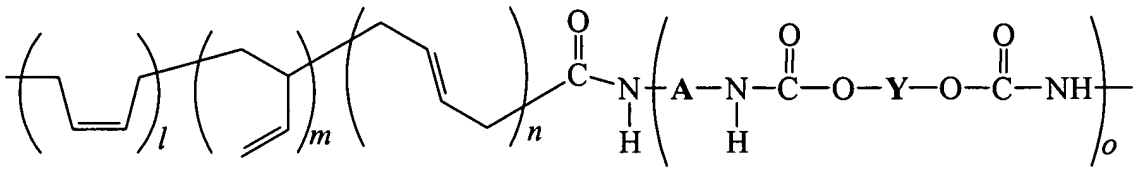
WHAT IS CLAIMED IS:

1. A high 1,4-cis polybutadiene-polyurethane copolymer represented by the following formula 1:

Formula 1

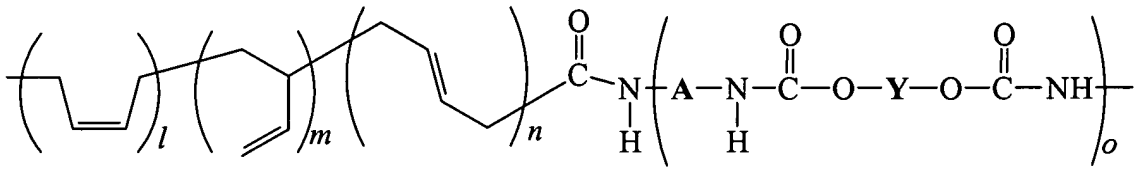


wherein l, m, n and o represent the number of repeating unit, l is 94 to 99 %, m is 0 to 5 %, n is 0 to 5 %, l+m+n = 100 %, 1/(m+n) is 15 to 100, o is 1 to 100 %; and A and Y are C_1-C_{20} alkyl or aryl, respectively.

2. The high 1,4-cis polybutadiene-polyurethane copolymer as claimed in claim 1, wherein the high 1,4-cis polybutadiene has a molecular weight of at least 100,000.

3. A method for preparing a high 1,4-cis polybutadiene-polyurethane copolymer represented by the following formula 1:

Formula 1



wherein l, m, n and o represent the number of repeating unit, l is 94 to 99 %, m is 0 to 5 %, n is 0 to 5 %, l+m+n = 100 %, 1/(m+n) is 15 to 100, o is 1 to 100 %; and A and Y are C_1-C_{20} alkyl or aryl,

the method comprising:

(a) polymerizing 1,3-butadiene or butadiene derivatives with a catalyst comprising a rare earth compound, a halogen-containing compound and an organoaluminum compound in the presence of a non-polar solvent, to prepare 1,3-butadiene or butadiene derivatives having a high 1,4-cis content of at least 95 %; and

(b) adding an isocyanate compound having at least two functional groups and an alcohol compound having at least two functional groups with or without base or tin catalyst to the result of the step (a).

4. The method as claimed in claim 3, wherein the isocyanate compound having at least two functional groups is represented by the following formula 2:

Formula 2

$R\text{-}(NCO)_n$

wherein R is C_1-C_{20} alkyl or aryl; and n is an integer of 2 to 4.

5. The method as claimed in claim 3, wherein the isocyanate compound having at least two functional groups is selected from the group consisting of C_1-C_{20} alkyl diisocyanate, C_1-C_{20} alkyl triisocyanate, C_1-C_{20} alkyl tetraisocyanate, C_1-C_{20} aromatic diisocyanate, C_1-C_{20} aromatic triisocyanate, or C_1-C_{20} aromatic tetraisocyanate.

6. The method as claimed in claim 4, wherein the isocyanate compound having at least two functional groups is selected from the group consisting of C_1-C_{20} alkyl diisocyanate, C_1-C_{20} alkyl triisocyanate, C_1-C_{20} alkyl tetraisocyanate, C_1-C_{20} aromatic diisocyanate, C_1-C_{20} aromatic triisocyanate, or C_1-C_{20} aromatic tetraisocyanate.

7. The method as claimed in claim 3, wherein the isocyanate compound having at least two functional groups includes polymethylene diphenyl diisocyanate.

8. The method as claimed in claim 4, wherein the isocyanate compound having at least two functional groups includes polymethylene diphenyl diisocyanate.

9. The method as claimed in claim 3, wherein the isocyanate compound having at least two functional groups is used in an amount of 0.01 to 50 parts by weight with respect to 100 parts by weight of the polybutadiene having a high 1,4-cis content of at least 95 %.

10. The method as claimed in claim 3, wherein the alcohol compound having at least two functional groups is represented by the following formula 3:

Formula 3

$R'-(OH)_m$

wherein R' is C_1-C_{20} alkyl or aryl; and m is an integer of 2 to 10.

11. The method as claimed in claim 3, wherein the alcohol compound having at least two functional groups is selected from the group consisting of C_1-C_{20} alkyl diol, C_1-C_{20} alkyl triol, C_1-C_{20} alkyl tetraol, C_1-C_{20} aromatic diol, C_1-C_{20} aromatic triol, or C_1-C_{20} aromatic tetraol.

12. The method as claimed in claim 10, wherein the alcohol compound having at least two functional groups is selected from the group consisting of C_1-C_{20} alkyl diol, C_1-C_{20} alkyl triol, C_1-C_{20} alkyl tetraol, C_1-C_{20} aromatic diol, C_1-C_{20} aromatic triol, or C_1-C_{20} aromatic tetraol.

13. The method as claimed in claim 3, wherein the alcohol compound having at least two functional groups includes glycol.

14. The method as claimed in claim 10, wherein the alcohol compound having at least two functional groups includes glycol.

15. The method as claimed in claim 3, wherein the alcohol compound having at least two functional groups is used in an amount of 0.01 to 50 parts by weight with respect to 100 parts by weight of the polybutadiene having a high 1,4-cis content of at least 95 %.

16. The method as claimed in claim 3, wherein the butadiene derivatives include isoprene, 1,3-pentadiene, 2,3-dimethyl-1,3-butadiene, myrcene, their mixtures or derivatives.

17. The method as claimed in claim 3, wherein the rare earth compound includes a rare earth organic acid, or a rare earth inorganic acid.

18. The method as claimed in claim 17, wherein the rare earth organic acid includes rare earth carboxylate.

19. The method as claimed in claim 18, wherein the rare earth carboxylate includes a carboxylate selected from C_8-C_{20} saturated, unsaturated, cyclic or linear octoate, naphthenate, versatate, or steate.

20. The method as claimed in claim 19, wherein the rare earth carboxylate is selected from neodymium versatate, neodymium octoate, or neodymium naphthenate.

21. The method as claimed in claim 3, wherein the halogen-containing compound includes a halogen-containing Lewis acid and organohalogen compound readily serving as a donor of halogen.

22. The method as claimed in claim 21, wherein the halogen-containing Lewis acid is selected from an aluminum compound represented by $MX_nR^1_{3-n}$, wherein M is aluminium, boron, silicon, tin or titanium; X is halogen atoms; R^1 is C_1-C_{10} alkyl or aryl, or hydrogen; and n is 1 or 2.

23. The method as claimed in claim 21, wherein the organohalogen compound includes t-alkyl halogen compounds.

24. The method as claimed in claim 3, wherein the organoaluminum compound is selected from the group consisting of trimethyl aluminum, triethyl aluminum, tripropyl aluminum, tributyl aluminum, triisobutyl aluminum, trihexyl aluminum, or diisobutyl aluminum hydride, as represented by AlR^2_3, wherein R^2 is C_1-C_{10} alkyl or aryl, or hydrogen.

25. The method as claimed in claim 3, wherein the non-polar solvent is selected from butane, pentane, hexane, isopentane, heptane, octane, isooctane, cyclopentane, methylcyclopentane, cyclohexane, methylcyclohexane, ethylcyclohexane, benzene, toluene, ethylbenzene, or xylene.

26. The method as claimed in claim 3, wherein the catalyst is used to provide a molar ratio of rare earth compound to chlorine element in the range from 1:1 to 1:20.

27. The method as claimed in claim 3, wherein the catalyst is used to provide a molar ratio of rare earth compound to alkylaluminum in the range from 1:20 to 1:100.

28. The method as claimed in claim 3, wherein the weight ratio of 1,3-butadiene or butadiene derivative to solvent is 10:1 ~ 1:1.

29. The method as claimed in claim 3, wherein the step (a) is performed a reaction time of 30 minutes to 3 hours.

30. The method as claimed in claim 3, wherein the step (a) is performed a reaction temperature of -20 to 100 °C.

31. The method as claimed in claim 3, wherein the step (b) is performed a reaction time of 5 minutes to 2 hours.

32. The method as claimed in claim 3, wherein the step (b) is performed a reaction temperature of 20 to 150 °C.